"FlatWorld" Transforms Reality

William 'Bill' Swartout, ICT's Director of Technology, has reason to be proud of his newest ICT project, 'FlatWorld.' Diane Piepol, the producer of this new project, along with researcher Jarrell Pair, are the creators. 'Flatworld' is a mixed-reality training and simulation system that integrates physical objects, digital walls, and real-time graphics along with Hollywood set techniques, creating a totally immersive experience. In its fully realized state, 'FlatWorld' will allow participants to walk and run freely through an expansive virtual world, unencumbered by equipment and wires.

The set construction techniques employed by Hollywood craftspeople created worlds that mimicked real environments . . . as well as fantasy realms. The ICT FlatWorld Project bears a relationship to now-traditional Hollywood stagecraft, but it also **moves beyond it.**

Participant in FlatWorld Demo

Currently, virtual reality educational environments employ head mounted displays, and large screens to immerse the viewer. These head mounted displays tend to tether the participant and they have severe limitations that restrict a person's freedom to move about physically as they would in the real world. In the

'FlatWorld' configuration, these issues and problems are addressed by

creating a system of "digital flats." Users have free range of motion to move about within the training space, without the use of head mounted display cables.

A single digital flat can function to appear as an interior room wall or as the face of an exterior building wall. By combining physical props and digital

Flats, doors and windows can then be simulated. Users can touch and open these portals to view an exterior virtual world. Digital flats can rapidly be assembled to simulate multiple situations in a variety of geographic locations. This approach creates a "mixed reality" world where the *physical and virtual worlds seamlessly coexist.* Digital flats are modular, allowing environments to be expanded from a single building to an entire city block.

The entrance to the FlatWorld one room prototype consists of a single physical flat. The flat is treated to appear as a weatherworn building complete with a weathered door and rusted tin roof.

The work of numerous ICT research projects in artificial intelligence (AI), virtual humans (VH), speech recognition, and graphics will impact the future of 'FlatWorld'. Avatars and AI infused characters, such as those seen in another one of ICT's

Interactive scenarios, the 'Mission Rehearsal Exercise' (MRE), will come to populate 'FlatWorld'. Furthermore, speech recognition as employed in the 'MRE' will bring an increasing level of technology to 'FlatWorld' training environments.

'FlatWorld' draws heavily on theme park design both in terms of presentation and technical design. It blends together the ability to combine building stages and theatrical sets with the development of interactive virtual environments.

Each area has limitations which 'FlatWorld' addresses. Two theme park attractions are relevant to some portion of the overall research and development problems 'FlatWorld' engages. They combine stereoscopic imagery, immersive audio, physical props, and sets, as does 'FlatWorld'.

- *Terminator-2 3D:* This attraction, located at Universal Studios Hollywood, is regarded by many as one of the most impressive uses of stereoscopic 3D cinema in the world. Traditional film projection is used in tandem with theatrical lighting to transform building walls into windows providing a view of a stereoscopic 3D world. A 24+ channel spatial audio system enhances the immersive effect.

- *The Amazing Adventures of Spiderman:* This ride at Universal Studios Islands of Adventure in Orlando, Florida illustrates how stereoscopic projection screens can be used to convincingly simulate alleys and urban corridors. The screens are integrated with physical buildings and props.

Both *'Terminator-2 3D'* and *'The Amazing Adventures of Spiderman'* highlight the need for an introductory

back-story or pre-show to provide users with the background information, narrative context and environments necessary to evoke a sense of "presence" or "being there."

User viewing exterior world through a physical door

Utilizing digital rear projection technology, the prototype digital flats measure approximately 8' high by 10' wide. 'FlatWorld' is a unique medium for training and simulation, unlike any other. As you walk into the staging area, you see the facade of a building, complete with dirt and debris around the perimeter. Upon entering the demo room, guests are given a pair of 3-D glasses to enhance their viewing experience. Once inside, visitors are transported through several virtual scenarios involving interaction with real windows, doors, and other movable props.

Guests view a helicopter in flight, a mountain lookout post, a "reach out and touch me" butterfly, and a hear a knock at the door, revealing a USC Robot from outer space, who offers everyone a friendly greeting.

Stereoscopic graphics allow objects to appear to float in space.

Visitors also experience a heavy down-pouring rainfall and a lifelike thunderstorm, produced via floor-mounted speaker, thus adding to the realism.

Behind the scenes, the current FlatWorld demo uses models created in Alias/Wavefront's Maya software. The graphics for the demo were written in the C/C++ programming

language utilizing the OpenGL graphics library. The immersive audio effects were implemented using Microsoft's Directsound3D interface. Each PC is equipped with NVIDIA graphics cards and the entire system utilizes common off the shelf equipment.

'Flatworld' provides a powerful, flexible tool for experiential education and training. As a virtual environment system, 'FlatWorld' is unique in its ability to create an immersive simulation in which a person's entire physical body is engaged.

In the future, 'FlatWorld' system components will be upgraded as new immersive techniques and display solutions emerge. For example, the research team is now in the process of testing the use of high definition video as an alternative to real time 3D graphics for 'FlatWorld' content. The project is also considering the development of a prototype digital flat using emerging display technologies such as electronic ink (developed at the Massachusetts Institute of Technology) or organic LED's (OLED) display (an emerging ideal digital flat display technology).

Since the 'FlatWorld prototype' demonstrations premiered in November 2001, approximately two hundred visitors from the entertainment, military, technology and academic communities have experienced this 'mixed reality' world.

Two digital flats simulating plaster walls in conjunction with table, window, and door props create a virtual room.

'FlatWorld' is only one of the ICT's numerous on-going, interactive, thought provoking and innovative proto-type projects

Army Research Institute Project Progresses

Researchers from the USC Institute for Creative Technologies (ICT) recently traveled to the U.S. Military Academy

at West Point to gather story data for an upcoming collaboration with the Army Research Institute. The project, titled "Interactive Vignettes for Leadership Training," will immerse potential Army leaders into interactive situations and allow them to evaluate the actions of characters.

Researchers Dr. Randall Hill, Dr. Andrew Gordon and Jay Douglas interviewed ten Captains who recently completed assignments as company commanders. The Captains are now on track to complete a masters degree program in Counseling and Leadership prior to becoming tactical officers at West Point. Over 60 stories were archived on video and audiotape and are being used to create a prototype scenario for the beta version of the software.

The Interactive Vignettes for Leadership Training" project will include the development of a filmed movie vignette of high production value that can be used both in an interactive and a non-interactive manner. When viewed non-interactively, the vignette will present to an audience a hypothetical history of events, carefully crafted to raise critical issues for a command staff that deal with specific leadership problems. When viewed in an interactive mode, additional functions will be provided to the trainees to help them acquire a cognitive protocol for military decision-making.

ICT is working towards a stronger collaboration with the Military Academy, hosting several cadets as summer interns. The army encourages the ICT to propose future projects for cadets, which will require their unique perspective and analysis as military personnel in training.

The ICT is collaborating with Hollywood producer, Kim Le Masters to produce the filmed component of the software. Le Masters served as President of CBS Television Entertainment Division and aided in the creation and development of some of television's biggest hit shows, including "Murphy Brown," "Dallas," "Knots Landing," "Wiseguy," "Magnum P.I." and "Silk Stalkings."

ICT Welcomes Interns and West Point Cadets

The ICT is proud to announce that in conjunction with our new project with ARI, we are fortunate to have three cadets from the West Point Academy join us this summer as interns.

Cadet Jeremy Taylor Cadet Michael Hamilton, a **Duff** from the U.S. Military Academy at West Point interned this summer for three weeks with Dr. Michael van Lent. He came to evaluate commercial off the shelf (COTS) military themed games as potential tools for military training. Cadet Duff developed a set of criteria by which to compare the games and then evaluated three current games. This evaluation explored how these games might be useful to the military in their current state and how they might be modified to be more useful. The games that he assessed are:

1. "Medal of Honor: Allied Assault"
2. "Delta Force Land Warrior"
3. "Americas Army: Operations"

Cadet Duff provided ICT with extensive written evaluations of these three games and will be continuing to evaluate more games during his third year at West Point. He also provided feedback on the "MRE" and "SEE" projects as well as participating in the ARI "Think Like a Commander" video demo with a number of other summer interns.

Cadet Duff was born in Bristow, Oklahoma and raised in Oklahoma and Utah. In high school, at the age of 17, he enlisted in the Army Infantry in 1997. He attended Oklahoma State University for one semester with a major in Civil Engineering. Enlisted training included stints at Ft. Benning, Georgia and Germany. He was ordered to Ft. Monmouth New Jersey, United States Military Academy Preparatory School in 1999 for the Army and entered the United States Military Academy, West Point New York with the class of 2004. He will graduate as 2nd Lieutenant with Bachelors of Science in Engineering Management and Civil Engineering.

Cadet Michael Hamilton will be joining ICT in early July. He is a computer science major, and will be joining Dr. Andrew Gordon on researching the natural language processing for the ARI project.

Buzz Aldrin, Cadets Duff & Lanphere

Cadet Kelly Ryan Lanphere was born in Santa Fe, New Mexico. He entered the United States Military Academy, West Point New York with the class of 2004.

He will graduate as 2nd Lieutenant with a Bachelors of Science in Engineering Management and Civil Engineering. Currently, he is a junior at USMA. He is working at ICT with Dr. Randy Hill and David Traum on testing the mobile for the Mission Rehearsal Exercise.

Summer Interns

David Burcham is a junior majoring in Computer Engineering and Computer Science (B.S.), with a minor in Math at USC. He was born in Long Beach, California.

At ICT, he is working on a project that deals with the Social Network Analysis of a Massively Multiplayer Game, namely Asheron's call. He wrote a program to collect selected information from the game. After compiling the data, analysis will be conducted. He will soon be starting to put some autonomous agents in Asheron's call with the help of Mike van Lent and another intern, Andrew Scholer.

Saurabh Garg was born on the 7th of July in Ludhiana, India. He is an electrical engineer working on his masters at the University of Southern California. He completed his schooling at St. Fransis De Sales School, New Delhi. He earned his bachelors in engineering from Delhi Institute of Technology, India.

Pushkar Joshi was born the small town of Nashik, India. He recently completed a bachelor's degree in computer engineering at USC. At ICT, Pushkar is working with Dr. Fred Pighin on facial animation.

Jason Justice was born in Wurzburg, Germany. He received his BFA with a focus in painting and drawing from the Corcoran School of Art in Washington D.C. He also completed a certificate-training program at Gnomon, Inc. School of Visual Effects in Hollywood.

Abe Kazemzadeh is working with Andrew Gordon on correlating linguistic forms (i.e. phrases, sentences, etc), with semantic and cognitive meaning, as a part of the ARI project. He just graduated from USC in linguistics, with a minor in natural sciences. Next year he is planning to start grad school in computational linguistics. He was born in Seattle, Washington.

Salvo Lavis grew up in Houston, Texas and now attends the University of Texas at Austin. This is his second summer here at ICT, during which time he'll be working on the ARI/TLAC project with Randy Hill and team.

Hyokyeong Lee is a Ph.D. candidate student in the Dept. of Computer Science at USC. She is currently working on directed research on emotional modeling for Jon Gratch.

Michael Levoff is a high school student at Harvard-Westlake, a private school in Beverly Hills. He is currently working as an intern with Jack Morie.

Krishna Mamidibathula was born in India and graduated from the Newhouse School of Public Communications at Syracuse University in New York. Krishna is working in the business office.

John Christopher Manko was born in Scranton, Pensylvania. He received a BS in Computer Science at the University of Scranton. He is currently enrolled in the University of Scranton. He is currently working with Jon Gratch, writing a tool for MRE that will map the agent's gesture schedule against its speech schedule.

Brian Manson was born in Columbus, Ohio. This fall he will be a senior at USC, majoring in Computer Science with a minor in animation. He is currently working on the FlatWorld project.

Michelle Kathryn McGinnis is Production Assistant to Diane Piepol Paul Debevec. She was born in Long Branch, New Jersey. She graduated from the School of Visual Arts in New

York City in May 2001, with a BFA, with a focus on 3D Animation.

Milena Petrova was born in Bulgaria. She attended Sofia University. In London, she worked as a PA to an artist, translator, and writer for the BBC World Service as well as a Business Development Executive for Harper Collins Publishers. She is currently working on the Interactive Vignettes for Leadership Project for Andrew Gordon.

Paul Reitsma was born in Nanaimo, British Columbia (Canada). He received a BS from University of British Columbia in 1998, and a MS at Brown University in 2001, and now he is currently affiliated with both Brown and Carnegie-Mellon universities.

He is working with Fred Pighin on allowing the motion graph to synchronize the motions of multiple characters when appropriate while allowing them to decouple when possible for maximum motion-generation flexibility.

Susan Robinson was born in Ann Arbor, Michigan. She attends USC in the school of Linguistics as a graduate student. She is currently an intern for David Traum working on MRE transcribing and coding data.

Scott Rocher was born in Houston, Texas. He is currently a junior at Southwestern University in Georgetown, Texas, pursuing a BA in Communication with a minor in Computer Science. Scott joins us again at ICT after serving for eight weeks last summer as the web design intern, designing the intranet system and setting up our Real Media server. He also assisted with the production of a video presentation of ENCLAVE.

This summer, Scott will be focusing on the ARI IV project as well as some updating of both the public website and intranet.

Andrew Scholar is interning for Mike van Lent.

Ming Tang is from China and studied Michigan for two years. He is currently a graduate student at Michigan State University and his major is Digital Media Art and Technology.

He is currently working in the Graphics Lab as an intern, on motion capture and character animation on the Parthenon Project.

Joel Tetreault was born in Burlington, Vermont. He completed his undergraduate degree at Harvard University and is currently working on his PhD. at the University of Rochester.

At ICT he is currently working with David Traum on developing a reference module for the natural language part of the MRE system.

Wen Tien was born in Taipei, Taiwan and moved to the US in 1993. He received his B.S. in CS&E from UCLA in 2001 and is currently a second year MSCS student at USC. He is working with Fred Pighin on motion editing

Charles (Charlie) Varner was born on October 24 in Pasadena, California. Charlie is primarily working on the Social Network Analysis for the Asheron's Call (SNAAC) project.

He is a recent graduate of Polytechnic High School in Pasadena, and he will be attending USC in the fall with a major in Computer Science.

Jessi Stumpfel is interning in the Graphics Lab.

Sheldon Lavis is interning in the business office. You can find him on the 5th floor gleefully reconciling past ICT accounts.

Kimberly "Kimmie" Davis was born and raised in Los Angeles, California. She recently completed her freshman year at Brigham Young University where she is majoring in Fashion Design. She is ICT's clerk/courier through the end of August. When not making the daily run to campus, you will find her handling her responsibilities around the office. Illinois.

Visitors to ICT

Recent VIP visitors to ICT include: Wynn Atterbury, Office of the Secretary of Defense; Frank Hughes, VP Tietronix (former director of astronaut training at NASA); instructors from West Point Academy (USMA); the Air Force Modeling & Simulation Office (AFMS); the Defense Science Board Task Force on Training Superiority and Training Surprise; the Singapore Defence Science and Technology Agency (DSTA); Lieutenant General Roy Beauchamp, Commanding General, US Army Materiel Command; Dr. Buzz Aldrin and members of the Aerospace Commission; Congresswomen Watson's and Waters' Offices.

Future VIP guests include: Dr. Michael Andrews, US Army Chief Scientist; the Director of the UK Synthetic Environments Co-ordination Office; General Abrams, Commanding General, TRADOC; the Army Research Lab; and the SIMCI Scenario Generation Value Methodology Workshop.

First Issue of ICT External Newsletter

Welcome to the first issue of the ICT External Newsletter. The goal of this new publication is to keep interested members of the ICT community informed about what is currently happening at the ICT**.**

We welcome your feedback and comments. Please contact us at news@ict.usc.edu.

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